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Research Article

Primula xilingensis (Primulaceae), a new species from Sichuan, China

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Abstract

A new species, *Primula xilingensis* K.Huang & Z.X.Fu, **sp. nov.** (Primulaceae), is described and illustrated. In gross morphology, it is clearly allied to section *Minutissimae* on account of having stolons, being glabrous, leaf rosette less than or equal to corolla, flower solitary and bract not swollen at base. The new species is easily distinguished by the combination of scape densely yellow farinose, leaf apex acute, rarely broadly obtuse, corolla pale purplish blue and style 3.0–6.0 mm above base of corolla tube, stamens reaching the corolla tube mouth in thrum flower. In addition, the distribution map, morphological comparison of related species and conservation status of the new species are also provided.

Key words: conservation, morphological characters, *Primula* sect. *Minutissimae*, taxonomy

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Introduction

The genus *Primula* L. is one of the largest genera in the Primulaceae, encompassing approximately 536 species (Ju et al. 2023; Li et al. 2023; POWO 2023; Wang et al. 2023; Wu et al. 2023a, b; Yang et al. 2023; Zhang et al. 2023). In China, the last comprehensive account of the genus was that of Hu and Kelso (1996) who treated 300 species in the "Flora of China". The additional several new species of *Primula* were added by e.g., Li and Hu (2009; one species), Xu et al. (2016a, b, 2017, 2022; four species), Wu et al. (2019; one species), Ju et al. (2021; one species), Wang et al. (2022; one species), Li et al. (2023; one species), and Yang et al. (2023; two species), bringing the total number of species in China to *c*. 340 species.

In China, *Primula* sect. *Minutissimae* Pax has approximately 17 species, and is abundantly distributed to Xizang, Yunnan and Sichuan provinces (Hu and Kelso 1996). This section can be distinguished by a set of morphological characters, in which members are dwarf perennial herbs, glabrous or with glandular hairs, often with stolons, leaf rosette less than or slightly larger than corolla, bracts small and not swollen at base, flower usually solitary, rarely 2–4, and capsule nearly as long as calyx (Hu 1990; Hu and Kelso 1996).

During a botanical expedition led by the last author to Xiling Snow Mountain, Dayi city, Sichuan Province in May 2022, a population of *Primula* was discovered, photographed and collected. Based on flowering taxon photos, the taxon appears to be closely related to *Primula tenella* King ex G.Watt. and *Primula dujiangyanensis* W.B.Ju, Bo Xu & X.F.Gao. After consultation with relevant literature and morphological examination of closely related taxa, it proved that it is eventually represents an unreported taxon of *P.* sect. *Minutissimae*. The new species can be differentiated from other members of this section by the combination of corolla pale purplish blue, scape densely yellow farinose with a solitary flower, and the style 3.0–6.0 mm above base of corolla tube, and stamens reaching the corolla tube mouth in thrum flower. Thus, it is described and illustrated as new to science below.

Material and methods

The observation and collection of both herbarium and living materials of the new species from Xiling Snow Mountain, Dayi city, Sichuan Province were conducted in May 2022 and June 2023. Morphological comparison of taxonomic literature of the closely related species, i.e. *P. dujiangyanensis* (Ju et al. 2021, herbarium CDBI, holotype, *DJY00272*), *Primula Pengzhouensis* C.M.Hu, G.Hao & Y.Xu (Xu et al. 2017, herbarium IBSC, holotype, *Xu16009*) and morphological comparison of specimens' images from Global Plants JSTOR (https://plants.jstor.org), i.e. *P. tenella* (herbarium K, holotype, *K000639442*, photo!, herbarium E, isotype, *E00024523*, photo!) were consulted. Morphological description and measurements of *P. xilingensis* were based on living plants. The taxonomic description follows the terminology used by Beentje (2016). The type and voucher specimens are stored at herbarium SCNU (follows Thiers 2023). The conservation status of the new species was assessed following the guidelines of the IUCN Red List categories and criteria (IUCN 2022).

Taxonomic treatment

Primula xilingensis **K.Huang & Z.X.Fu, sp. nov**
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Diagnosis. The new species is easily recognised by the following combination of characters: the scape densely yellow farinose, leaf apex acute, rarely broadly obtuse, corolla pale purplish blue and the style 3.0–6.0 mm above base of corolla tube, and stamens reaching the corolla tube mouth in thrum flower (Figs 1–3).

Type. CHINA. Sichuan: Dayi City, Xiling Snow Mountain, growing on moist rock surfaces amidst moss under the forest. 30°41'59.82"N, 103°9'47.63"E, alt. *c.* 3200m, 7th June 2023 (fl.), *K. Huang & Zhixi Fu 7531* (holotype, SCNU!) (Figs 1–3).

Description. A perennial herb, 1.0–4.0 cm tall. **Stolons** dark red, 2.0–6.0 cm long developing onwards leafless flagellate, each with a tiny rosette at the end, and clothed the base by the withered remains of the old leaves. ***Roots*** numerous, fibrous, without hairs, 3.0–12.0 cm long. ***Leaves*** in a loose to tight rosette, 1.0–2.0 cm in diameter, leaf rosette less than or equal to corolla; leaf blade ovate to ovate–elliptic, 5.0–8.0 × 3.0–6.0 mm, margin dentate generally in the upper half only, apex acute, rarely broadly obtuse, tapering to base forming a winged

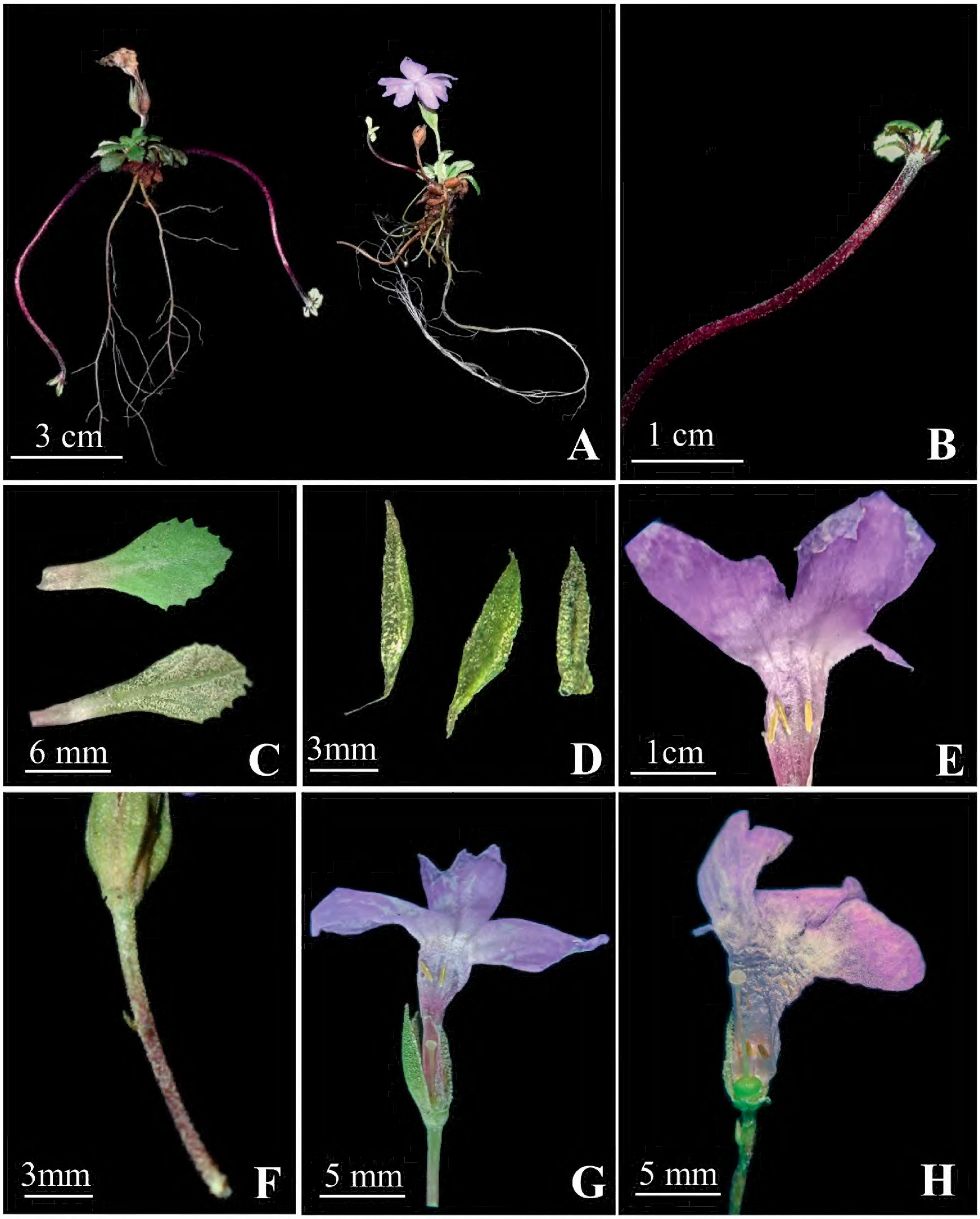


Figure 1. *Primula xilingensis* sp. nov. **A** plant and roots **B** stolon **C** leaves **D** calyx **E** stamens **F** scape and bract **G** thrum flower **H** pin flower. (Photos **A, B** by XM, and **C–H** by MZ).

petiole, petioles usually shorter than leaf blade and sparingly farinose, densely yellow farinose abaxially, midvein prominent, sparingly yellow farinose adaxially, veins inconspicuous. ***Scape*** solitary, 0.2–1.5 cm tall, erect, densely yellow farinose, usually with a single flower. ***Bracts*** solitary, 1.0–2.0 mm long, lanceolate, not swollen at base. ***Pedicel*** slightly bent, densely yellow farinose. ***Flowers***

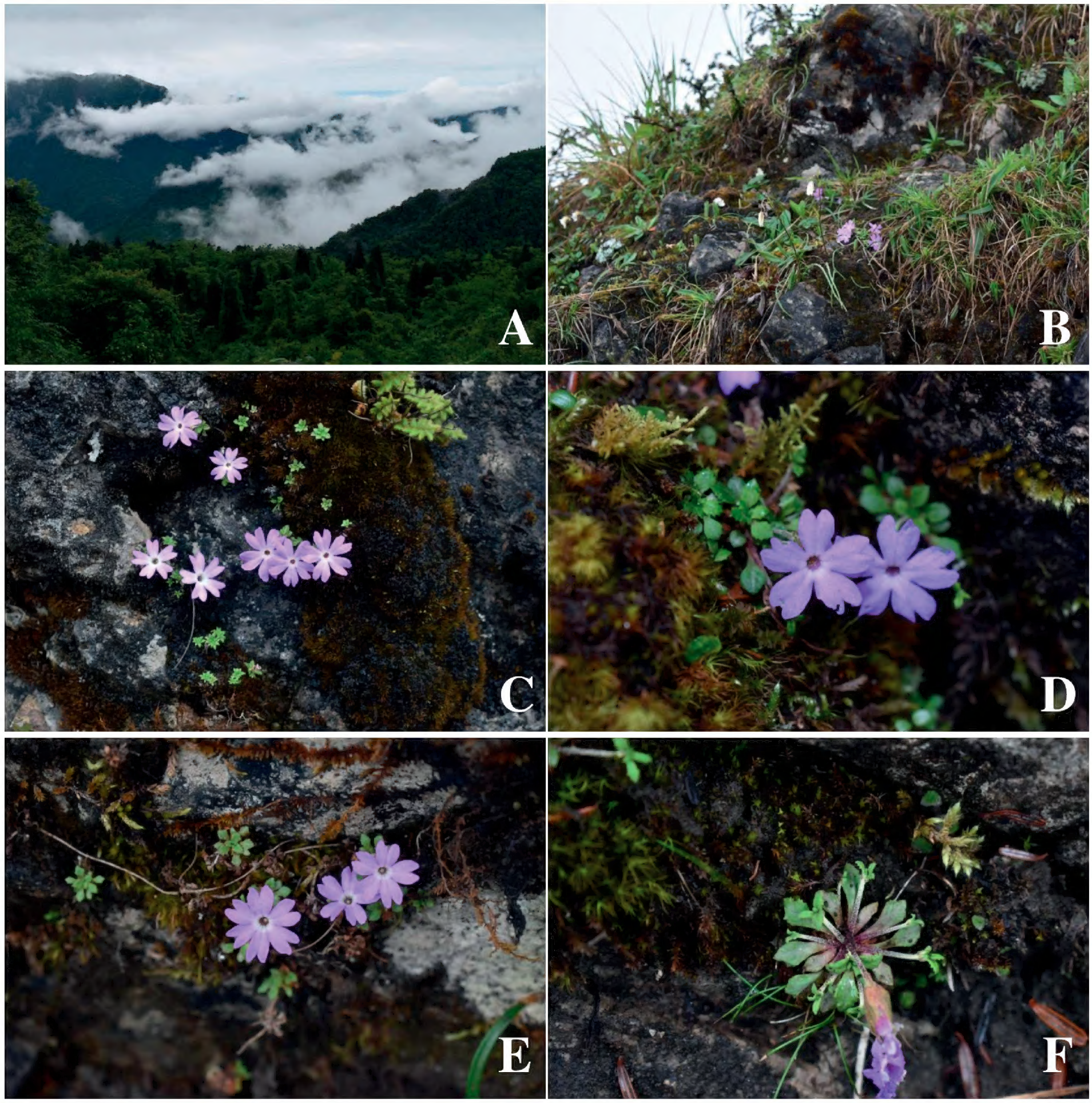


Figure 2. *Primula xilingensis* sp. nov. **A, B** habitat **C** plants of thrum flower **D** habit **E** plants of pin flower **F** stolons. (Photos **A, B** by ZF, **C, D** by KH, and **E, F** by MZ).

heterostylous. ***Calyx*** narrowly campanulate, prominent 5-veined, 3–9 mm long, densely yellow farinose, parted to 2/3 of its length or slightly below, lobes linear lanceolate to lanceolate, apex acute. ***Corolla*** pale purplish blue, lacking the appendage on the corolla tube, 5 lobes spreading, obovate, 4.0–8.0 mm long, densely yellow farinose abaxially, efarinose and glabrous adaxially, deeply emarginate. ***Pin flower*:** corolla tubes 5.0–10.0 mm long in length, 2–3 mm in diameter, longer than calyx, stamens 2.0–5.0 mm above base of corolla tube, style nearly as long as tube. ***Thrum flower*:** corolla tubes 7.0–13.0 mm long in length, *c*. 3 mm in diam, longer than calyx, style 3.0–6.0 mm above base of corolla tube, stamens reaching the corolla tube mouth (Figs 1–3). ***Capsule*** unknown.

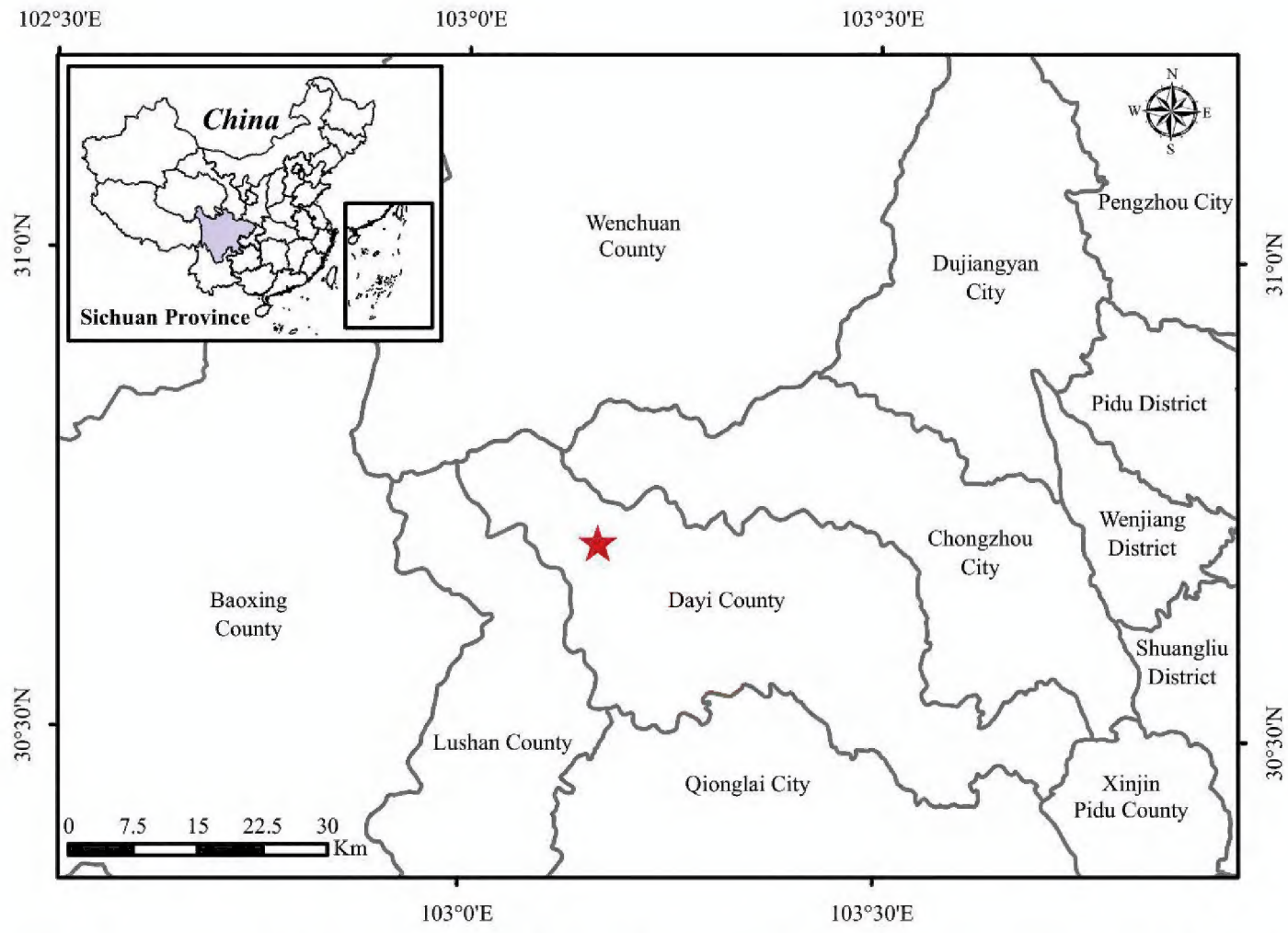
Phenology. Flowers collected in May and June.

Figure 3. Holotype image of *Primula xilingensis* K.Huang & Z.X.Fu, sp. nov.

Etymology. The epithet "*xilingensis*" is derived from Xiling Snow Mountain, the snow mountain located in Dayi City, Sichuan Province, China.

Distribution and habitat. *P. xilingensis* is currently known only from its type locality in Yingyangjie, Xiling Snow Mountain, Xiling Town, Dayi City, Sichuan Province, China (Map 1). It grows on moist rock surfaces amidst moss under the forest, at elevations of approximately 3200 m (Fig. 2).

Additional specimens examined (paratypes). CHINA. Sichuan: Dayi City, Xiling Snow Mountain, 30°41'59.82"N, 103°9'47.63"E, 21 May 2022 (fl.), *Zhixi Fu 6052* (SCNU!); ibid., 7 June 2023 (fl.), *K. Huang & Zhixi Fu 7532 & 7533* (SCNU!).



Map 1. Location of the population of *Primula xilingensis* in Dayi County, Sichuan (red star).

Conservation status. Data Deficient (DD). Currently, only one population with more than 100 individuals has been found in the type locality. The population of *P. xilingensis* grows on moist rock surfaces amidst moss, and the Xiling Snow Mountain has corresponding protective measures for the environment and plants. Whilst currently only known from Xiling Snow Mountain, it is very possible that the taxon is found in other localities and, without a more comprehensive collecting programme, and known only from two collections, it would be best to assess the conservation status of the species as Data Deficient (DD) following the IUCN Red List criteria (IUCN 2022).

Relationship with related species. Critical examination of collected specimens, comparison with type material of allied taxa, and relevant taxonomic literature revealed that *P. xilingensis* is a new member of the *P.* sect. *Minutissimae*. Morphologically, *P. xilingensis* shares certain similarities with *P. dujiangyanensis*. However, *P. xilingensis* differs from *P. dujiangyanensis* in having the style nearly as long as tube in pin flowers (vs. the style slightly exceeding the corolla tube mouth in pin flowers), stamens reaching the corolla tube mouth in thrum flowers (vs. stamens inserted on the apex of the corolla tube, scarcely exceeding 1 mm in thrum flowers), lacking an appendage on the corolla tube (vs. a yellow appendage present on the corolla tube), having numerous roots without hairs (vs. few roots with dense white hairs), corolla pale purplish blue (vs. corolla pinkish purple), leaf apex acute (vs. leaf apex broadly obtuse to sub-rounded) and distributed at about 3200 m elevation (vs. 1550–1650 m). To some extent, it also resembles *P. tenella* as a perennial herb with stolons, farinose leaves, margin dentate generally on the upper half only, but differs from *P. tenella* in leaf blade (ovate to ovate-elliptic vs. rhomboid to ovate-spatulate), leaf size (5.0–8.0 × 3.0–6.0 mm vs. 6.0–15.0 × 5.0–8.0 mm), leaf farinose (yellow vs. white) and altitude (at an altitude of approximately 3200 m vs. 4700–5000 m). The species of *P. xilingensis* is similar to *P. pengzhouensis*,

Table 1. Morphological characters comparison between *P. xilingensis* and closely related species of *P. dujiangyanensis*, *P. pengzhouensis* and *P. tenella*.

Features	*P. xilingensis*	*P. dujiangyanensis*	*P. pengzhouensis*	*P. tenella*
Roots	numerous, without hairs	few, dense white hairs	unknown	unknown
Stolon	2.0–6.0 cm long	3.0–6.0 cm long	absent	short leafy stolons
Leaf blade	ovate to ovate-elliptic, 5.0–8.0 × 3.0–6.0 mm	ovate to ovate-elliptic, 4.0–8.0 × 3.0–5.0 mm	elliptic to ovate elliptic, 2.0–3.5 × 1.5–2.2 cm	rhomboid to ovate-spatulate, 6.0–15.0 × 5.0–8.0 mm
Leaf farinose	abaxially densely yellow farinose, adaxially sparingly yellow farinose	abaxially copiously yellow farinose, adaxially sparingly yellow farinose	abaxially more or less covered with a fugacious yellow farina, adaxially efarinose	abaxially copiously white farinose, adaxially densely glandular and sparingly white farinose
Leaf apex	**acute, rarely broadly obtuse**	broadly obtuse to sub-rounded	broadly obtuse to sub-rounded	subrounded, rarely acute
Leaf margin	margin dentate generally in the upper half only	margin dentate or crenulate generally in the upper half only	margin serrate–dentate	margin usually denticulate or crenulate above middle
Scape	scape 1, 0.2–1.5 cm tall, usually with a single flower	scape 1, 1.0–2.5 cm tall, usually with a single flower, very rarely two	scape almost obsolete, at most 2.0 mm tall, bearing one terminal flower.	Scape 1, 2.0–5.0 cm tall, bearing 1(or rarely 2)-flowered
Scape farinose	**densely yellow farinose**	scarcely farinose	unknown	scarcely farinose
Calyx	narrowly campanulate,	narrowly campanulate	narrowly campanulate	narrowly campanulate
Calyx farinose	densely yellow farinose	sparingly yellow farinose outside, densely so inside	sparingly yellow farinose outside, parted slightly beyond middle	glandular outside, copiously white farinose inside
Corolla	**pale purplish blue**	pinkish purple	corolla rose or pale purple	corolla blue-violet
Corolla farinose	abaxially densely yellow farinose	unknown	sprinkled with yellow farina outside	unknown
An appendage on the corolla tube or not	absent	yellow appendage	absent	white appendage
Pin flowers	stamens 2.0–5.0 mm above base of corolla tube, style nearly as long as tube	stamens in the middle of corolla tube; style slightly exceeding the corolla tube mouth	stamens *c*. 3 mm above base of corolla tube, style *c*. 2/3 as long as corolla tube	stamens *c*. 3 mm above base of corolla tube, style reaching mouth
Thrum flowers	stamens reaching the corolla tube mouth, style 3.0–6.0 mm above base of corolla tube	stamens inserted on the apex of the corolla tube, scarcely exceeding 1 mm; style in the middle of the corolla tube	stamens up to 2/3 of corolla tube; style *c*. 3 mm	stamens at middle of corolla tube; style *c*. 3 mm
Altitude and distribution area	*c*. 3200 m, Dayi City, Sichuan Province	1550–1650 m, Dujiangyan City, Sichuan Province	*c*. 1170 m, Pengzhou City, Sichuan Province	4700–5000 m, Sounthern of Xizang Province

but can be easily distinguished from the former by its stolons (present with 2–6 cm long vs. absent), scape visibility (vs. almost obsolete) and altitude (*c*. 3200 m vs. *c*. 1170 m). Further morphological comparisons among the species of *P. xilingensis*, *P. dujiangyanensis*, *P. pengzhouensis*, and *P. tenella* are shown in Table 1.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Author contributions

ZF and KH collected this species. XL, HC, XM and TL performed the data analysis. JL and MZ wrote the manuscript. JL revised the manuscript. All authors have read and approved the final manuscript.

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

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